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ABSTRACT

Ten learning stations dealing with solid waste comprise the seminar described in this booklet. At each station, students observe a display and then answer questions listed on their data sheets. Although the seminar was intended for junior high school students, it has been used successfully with upper elementary and adult participants. Among the topics studied are composting, recycling of rubber and metal products, methods of waste disposal, and the "throw-away" mentality. The guide includes directions for building each station display, a materials list, estimated cost, and a diagram or photograph of the completed exhibit. Also provided are a solid waste quiz, sample student data sheet, background information for teachers, and questions for class discussion. (WB)

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SOLID WASTE SEMINAR INTRODUCTION

The solid waste activities described in this booklet were designed and prepared by the members of the Southeast Regional Environmental Education Council (REEC). They were constructed in the fall of 1977, and in less than a year, have been used by over 4000 individuals. The REEC has supported them to schools in southeast Minnesota, as well as to fairs, nature centers, churches, and adult classes.

This booklet contains complete directions for duplicating ten of the eleven activities. Included are detailed working drawings, photographs, a description of each activity, a materials list, a cost estimate, the text of each directions sign which tells the participant what to do, and copies of all teaching materials intended for use with the activities. The teaching materials may be duplicated.

The program was designed for junior high level, but it has been used successfully with upper elementary and adult participants.

The cases which hold the displays are all built by dadoing the pine framing and inserting the 1/2" plywood into the dado in the frame. The joints are glued and nailed. The cases are each painted a different color with enamel. Each direction signs can be color coordinated to its activity. A LeRoy lettering device is recommended, using the templates requiring #8 and #5 pens. Other lettering is available from pressure sensitive dry-transfer letters to freehand magic marker.

The drawings in this booklet were prepared by Gerri Meyer and John Lodermeier of Rochester Area Vocational Technical Institute. Photos are the work of Larry Meyer of Quarry Hill Nature Center.

If further information is needed about this program, contact Director, Quarry Hill Nature Center, 701 Silver Creek Road N.E., Rochester, MN 55901.

ACTIVITY 1 - Mountains of Waste

MATERIALS

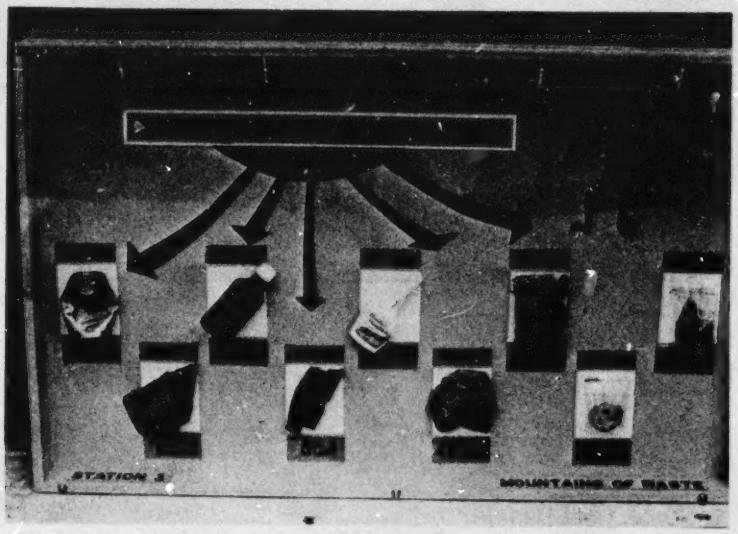
10 sq.ft. 3/4" AD plywood
10 sq.ft. 3/16" plexiglass
14 lineal ft. 1"x 4" pine
12 3/4" screws/finishing washers
1 drawer handle
Assorted junk (see description)
assorted letters and numbers
3 very sturdy, small, clear plastic bags
tag board
mounting board

Approximate cost $40.00

Refer to Activity 4 for construction details.

DIRECTIONS SIGN

MOUNTAINS OF WASTE
This activity shows the amounts and kinds of solid waste produced by every person in the U.S. each year. Record on your data sheet the total amount of waste produced and the amount listed for each category of solid waste.



DESCRIPTION

The purpose of this activity is to show the volume of solid waste produced by each person in the U.S. each year, and to identify what are the kinds of wastes which make up the total. Statistics were taken from the 3rd Report to Congress by the Environmental Protection Agency. Each kind of waste is identified by an appropriate piece of junk wired onto a 4" x 5" piece of mounting board with its name appearing above and its percentage of the total appearing below. The categories of metals, glass, plastics, yard, rubber, wood, paper, food, and misc., are represented respectively by a crumpled beer can, a small glass bottle, a small plastic bottle, a bag, a bag of cookies, and a bag containing chips of masonite, concrete, and rubber. Yarn was used for the "stick" person, but a cut-out, sketch, paper doll or doll could be substituted.

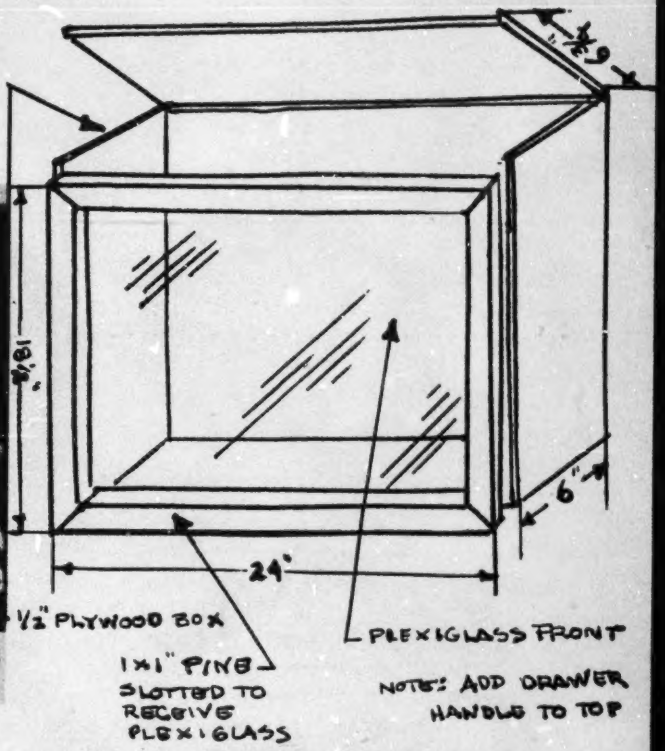
ACTIVITY 2 - Separate & Salvage

NOT COMPLETED AT THE TIME OF PUBLICATION

ACTIVITY 3 - NATURE'S RECYCLING

DESCRIPTION

In this activity, students will guess the amount of time it takes nature to completely reclaim a variety of natural and man-made items. Since there is no way they can know exactly, the purpose of the activity is to generate good guesses based on good reasoning and good discussion. A great deal of help in aiding good discussion can be found in the Teacher Data Sheet. Participants will conclude that nature cannot be expected to reclaim everything produced and that people need to find means of disposal other than throwing all wastes away. The model contains scraps of iron, plastic, paper, wood, bread, aluminum, glass and plant materials embedded in dirt. To make the model lighter in weight, pieces of styrofoam were used to fill the model, and dirt was added in sufficient quantity only to cover the imbedded scraps. The plexiglass face makes it possible to watch what is happening "underground."



MATERIALS

11 sq. ft. 1/2" AD plywood
3 sq. ft. 1/10" plexiglass
7 lineal ft. 1"x 1" pine
24" piano hinge
1 drawer handle
nails and glue
pop can, wood scrap, snuff box,
plastic bottle, corn cob, hot dog bun,
glass bottle, paper
assorted letters
tag board

Approximate cost $15.00

DIRECTIONS SIGN

NATURE'S RECYCLING

This display shows a number of man made and/or natural items. Each of these is identified by a letter. On your data sheet, write the amount of time you think it will take each item to disintegrate.

ACTIVITY 4 - OUR "TIRED" ENVIRONMENT

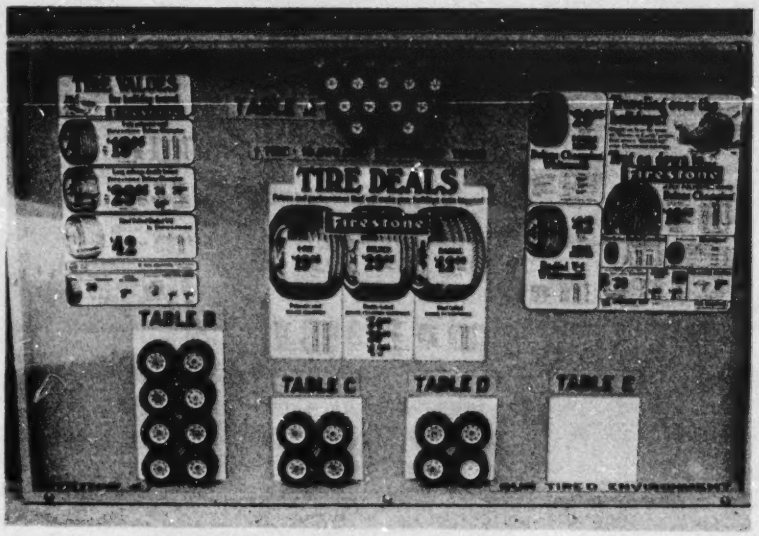
DESCRIPTION

The purpose of this activity is to help drivers and future drivers make environmentally sound choices when purchasing tires. Tire ads were used merely for design, and are not part of the activity. Toy tires are fastened to the plywood backing with screws. If toy tires are not available, pictures from ads or paper cutouts could be substituted.

MATERIALS

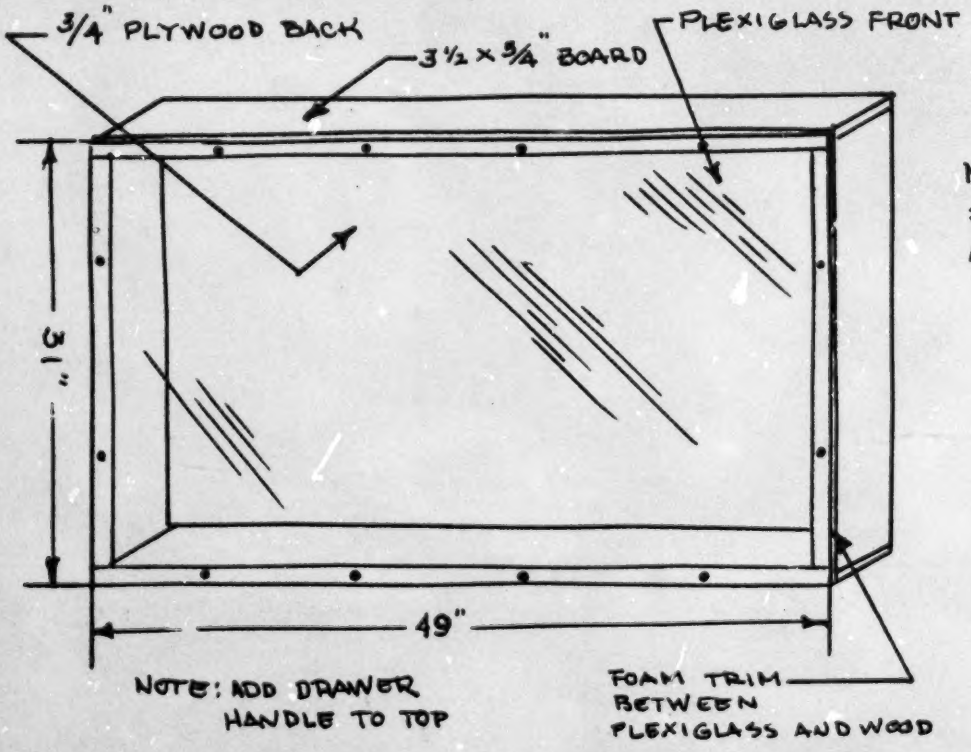
10 sq.ft. 3/4" AD plywood
10 sq.ft. 3/16" plexiglass
14 lineal ft. 1"x 4" pine
12 3/4" screws/finishing washers
33 toy tires
33 wood screws
drawer handle
assorted letters and numbers
tag board
newspaper ads

Approximate Cost $40.00



DIRECTIONS SIGN

OUR "TIRED" ENVIRONMENT
This activity deals with the problem of automobile tire disposal. Study the display and the questions on the data sheet.



NOTE:
STATIONS 1, 4, 5, 6
ARE IDENTICAL

ACTIVITY 5 - Do We Need To Recycle

MATERIALS

10 sq.ft. 3/4" AD plywood
10 sq.ft. 3/16" plexiglass
14 lineal ft. 1"x 4" pine
12 3/4" screws/finishing washers
drawer handle
Assorted letters and numbers
Map of the world
Yarn and glass head pins
Assorted tag board

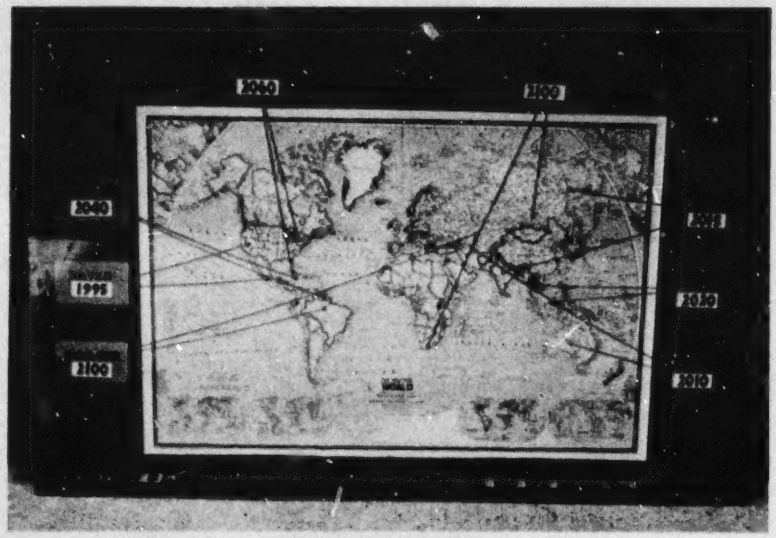
Approximate cost $40.00

DIRECTIONS SIGN

DO WE NEED TO RECYCLE?
A world map shows the sources of various metals. The number beneath each metal name is the year that the supply of that metal is expected to be gone. Record these years on your data sheet.

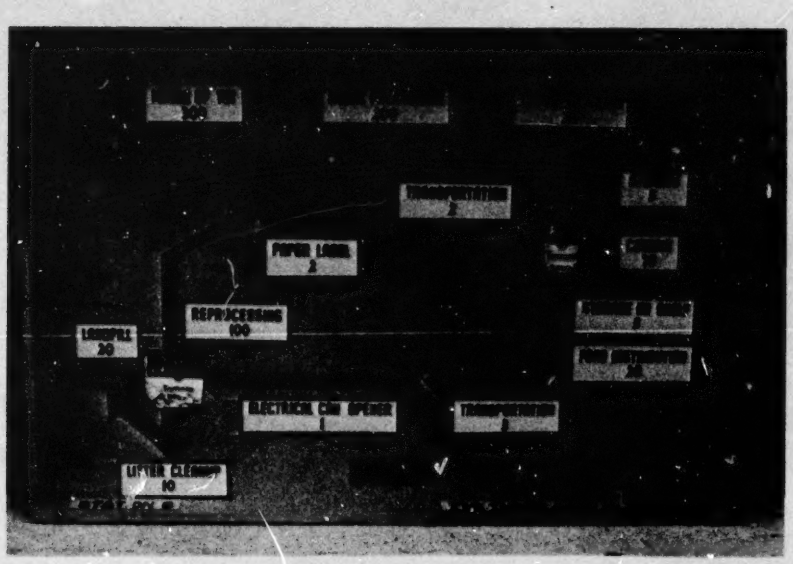
DESCRIPTION

This activity identifies the years in which certain metals will be depleted, providing no new supplies are found, and providing we neither increase nor decrease our current rate of consumption. It also shows some of the sources of the metals. The map used on the model is from National Geographic. Sources chosen for chromium are Russia and South Africa; for iron, Russia and Brazil; for nickel, Canada and Cuba; for aluminum, Jamaica and Dutch Guiana; for tin, Malaysia and Thailand; for copper, Russia and India; for lead, Australia and Russia; and for silver, Nevada and Mexico. The source for these statistics is: Living in the Environment: Concepts, Problems and Alternatives by G. Tyler Miller, Wadsworth Press, 1975. The name of each metal, with its runout date, is shown on tag board and is connected to its countries of origin with colored yarn.



Refer to activity 4 for construction details

ACTIVITY 6 - THE THROW-AWAY MENTALITY



DESCRIPTION

The energy units (BTU's) are given for each step in the production, use and disposal of a soup can. By following black arrows beginning at the upper left, one arrives at a total of 663 BTU's consumed. The red arrow, proceeding up and then to the right from the crushed can, shows the alternative of recycling (reprocessing) the can instead of disposing of it. Recycling (reprocessing) the can costs 100 BTU's while disposing of it and mining the tin for a new can costs 330 BTU's. Reprocessing, therefore, will save 230 BTU's or about 1/3 of the total energy consumed. Students are asked to add the total energy units consumed both with and without reprocessing, and to compare the two totals.

MATERIALS

10 sq. ft. 3/4" AD plywood
10 sq. ft. 3/16" plexiglass
14 lineal ft. 1" x 4" pine
12 3/4" screws/finishing washers
2 soup cans
Drawer handle
Assorted letters and numbers
1" strips of black and red tagboard

Approximate Cost $40.00

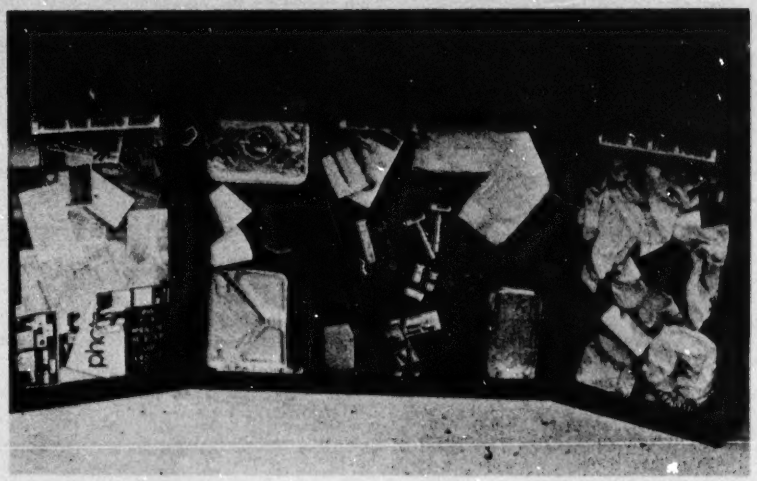
Refer to Activity 4
for construction
details

DIRECTIONS SIGN

THE THROW-AWAY MENTALITY

This is a flow-chart of the energy needed to produce a can of soup, distribute it to a grocer and have it consumed and disposed of. Follow the black arrows on the flow-chart and record the energy units needed to manufacture, fill, empty, and dispose of the can. Follow the red arrow and record the cost of recycling. Put your answers on the data sheet.

ACTIVITY 7 - WHAT IS NEEDED?



DESCRIPTION

This activity examines the relationships between solid waste and items designed to be used once and thrown away. The Teacher Data helps the participants to examine economic, volume, and ethical dimensions of choosing disposable items. Any disposables can be used in constructing the model, but should include razors, diapers, and fast foods packaging because those three are discussed in the Teacher Data material. Metal, plastic and glass items will need to be wired onto the plywood.

MATERIALS

7½ sq. ft. 3/4" AD plywood
10 sq. ft. 1/2" AD plywood
10 sq. ft. 3/16" plexiglass
2 24" piano hinges
1 drawer handle
2 latches
Assorted letters and numbers

LEFT PANEL:

Assortment of packaging and stuffers from photo shop

MIDDLE PANEL:

Assorted throw-away items including diaper and razor

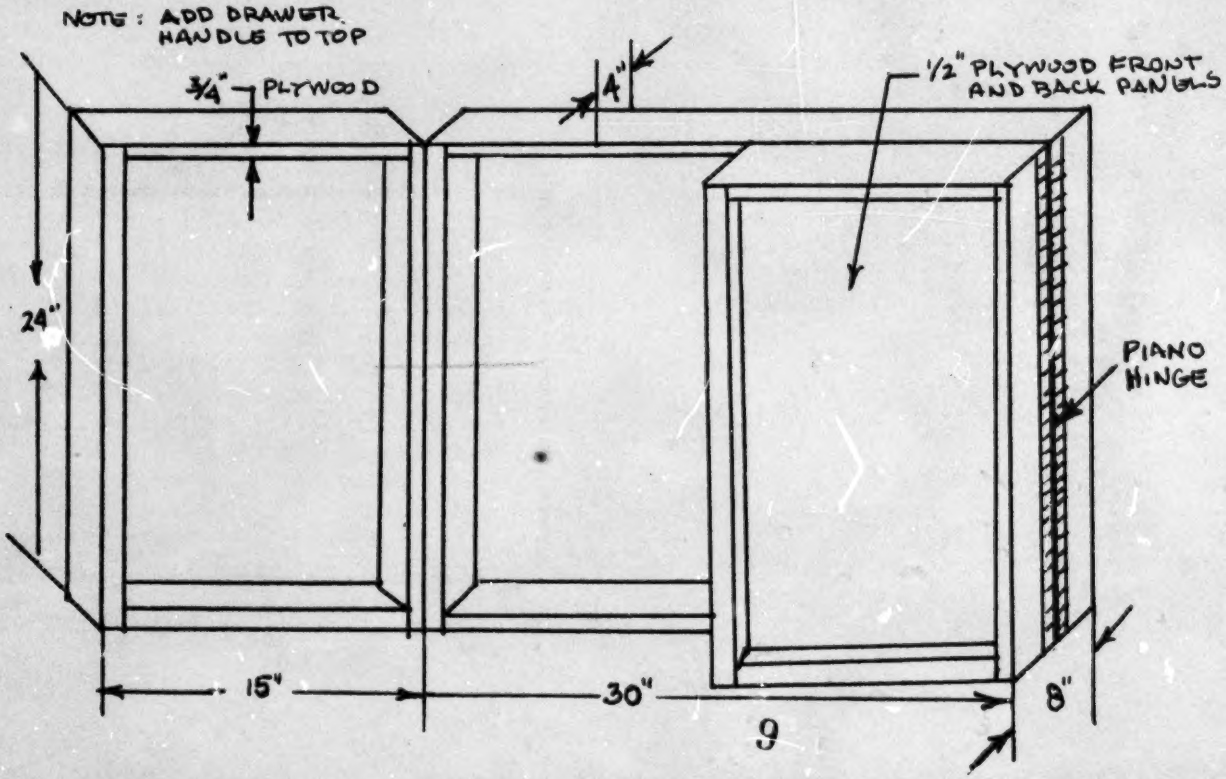
RIGHT PANEL:

Assortment of packaging from fast-foods places.

Approximate cost $43.00

DIRECTIONS SIGN

WHAT IS NEEDED?
One of the ways to reduce solid waste is to reduce it at the source. This activity shows some of the unnecessary solid waste which is given to customers The center panel shows items sold as disposable items.



ACTIVITY 8 - HUMAN PACKAGING

MATERIALS

7½ sq. ft. 3/4" AD plywood
10 sq. ft. 1/2" AD plywood
10 sq. ft. 3/16" plexiglass
2 2½" piano hinges
1 drawer handle
2 latches
Assorted letters and numbers

LEFT PANEL:

packaging from 18 oz. pkg. of cereal

CENTER PANEL:

4 sturdy clear plastic bags
cereal from large box and
cereal from variety pack

RIGHT PANEL:

Packaging from 18 oz. variety pack

Approximate cost $45.00

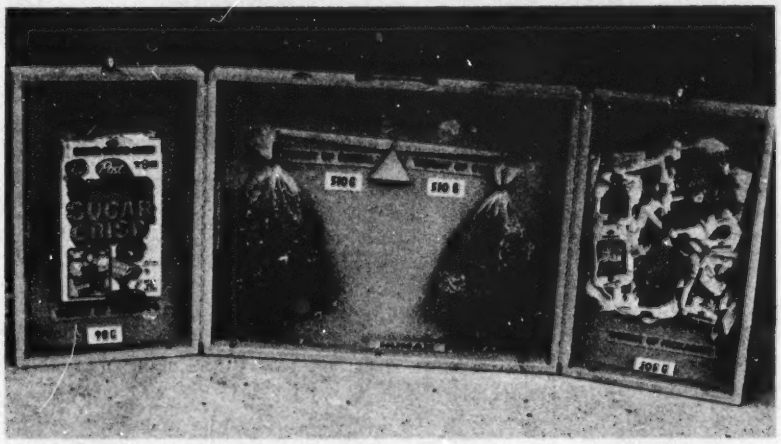
Refer to Activity 7 for construction details

DIRECTIONS SIGN

HUMAN PACKAGING
This display shows the difference in solid waste production between a single package and many smaller packages. Record the weight of the cereal and the weight of the packaging in each case.

DESCRIPTION

This activity helps make the participant aware of the poor conservation, increased solid waste, and unwise economics involved in purchasing cereal in variety packs instead of single boxes. The lettering on the model and the Teacher Data are based on 18 oz. of cereal. Figures can be adjusted for another weight. The scale is constructed of wood painted silver, and the bags are suspended from hooks by rubber bands. All the packaging is displayed, and is glued into place.



ACTIVITY 9 - COMPOSTING

MATERIALS

2 pieces 3/4" plywood 10" x 30"
1 piece 1/2" plywood 14" x 30"
1 piece 1/2" pine 6" square
3 gal. jars
1 electronic thermometer
wiring
nails and glue
scraps of glass, metal and paper
food waste
assorted letters and numbers
tagboard

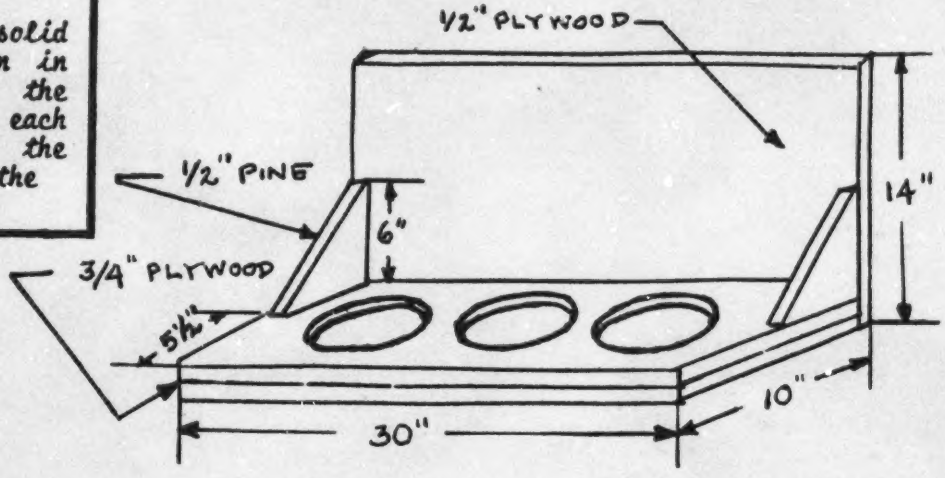
Approximate Cost $30.00

DESCRIPTION

In this activity it will be shown that organic materials can be used for composting because they decompose, and that inorganic materials are not suitable for compost because they do not. Jar A is filled with metal, Jar B contains food wastes and paper, and Jar C contains glass. Each jar is wired to an electronic thermometer. The higher temperature in Jar B is an indication that bacterial action is taking place.

DIRECTIONS SIGN

COMPOSTING
Three types of solid waste are shown in the jars. Read the thermometer in each jar and record the temperature on the data sheet.



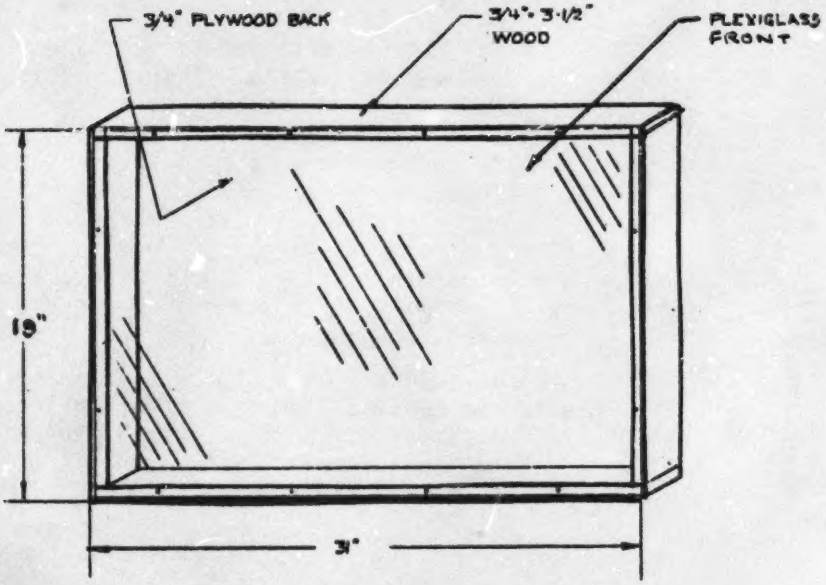
ACTIVITY 10 - NATURE'S PACKAGING

5 sq. ft. 1/2" AD plywood
5 sq. ft. 3/16" plexiglass
9 lineal ft. 1"x 4" pine
6 screws/finishing washers
1 large drawer handle
plastic orange
fiber tray
saran wrap
cash register slip
paper bag
trading stamps
game cards or other promotional gimmicks
assorted letters and numbers
tag board

Approximate Cost $20.00

DESCRIPTION

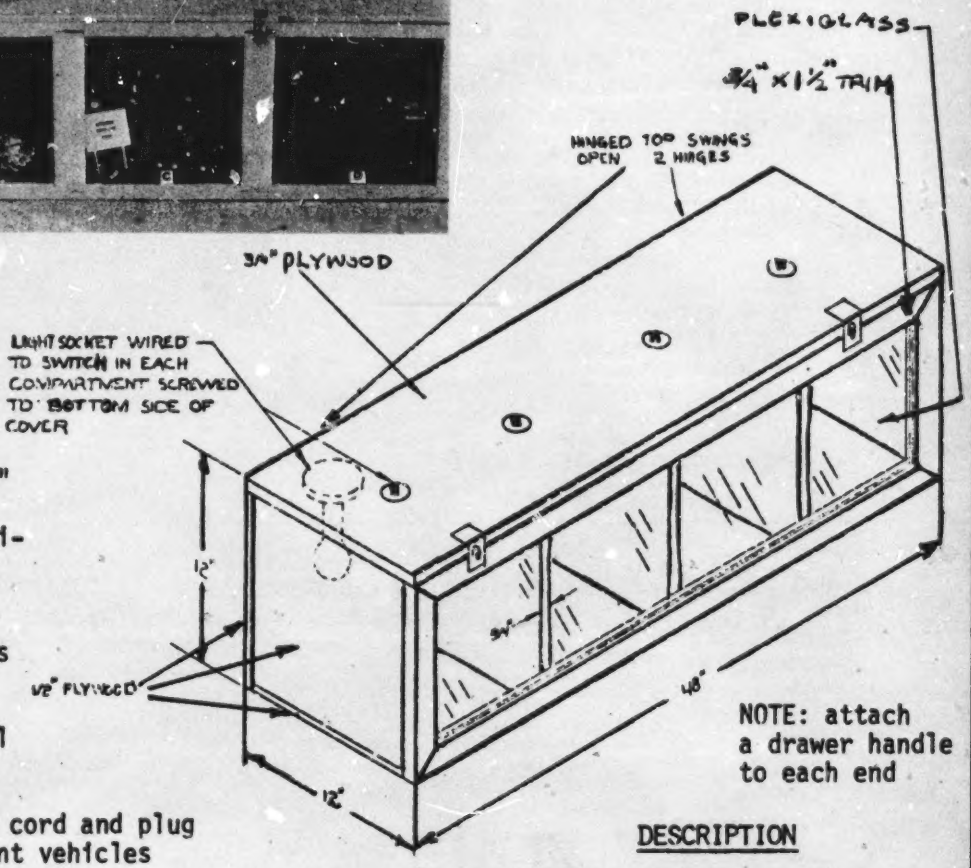
The purpose of this activity is to allow the participants to discuss and compare the packaging provided by nature and the added packaging provided by the grocery store. The Teacher Data Sheet suggests interesting points for discussion.



DIRECTIONS SIGN

NATURE"S PACKAGING
Observe the display and answer the two questions on the data sheet.

ACTIVITY 11 - METHODS OF DISPOSAL



NOTE: attach a drawer handle to each end

MATERIALS

13 sq. ft. 1/2" AD plywood
4 sq. ft. 3/4" AD plywood
13 lineal ft. 1½ x3/4" pine
4 sq. ft. 3/16" plexiglass
4 porcelain light sockets
4 15 watt light bulbs
4 Edwards #821 push button switches
4 sq. ft. sun control film
2 drawer handles
heavy duty electrical cord and plug
4 toy waste management vehicles
2 hinges
2 clasp hooks
4 appropriate pictures
assorted found objects for dioramas
assorted letters and numbers

Approximate Cost $80.00

DIRECTIONS SIGN

METHODS OF DISPOSAL
Look in each compartment in the box and record on your data sheet the disposal method illustrated.

DESCRIPTION

this activity is designed to demonstrate four methods of disposal of solid waste. A- contains a farm tractor and manure spreader with a farm scene in the background; B-contains a picture of a power plant in the background and a packer truck dumping a load of shredded paper as a fuel source for the plant; C-shows a recycling truck in a shopping center parking lot; and D-represents a sanitary landfill with a styrofoam base and a bulldozer and backhoe.

The plexiglass fronts on the model are covered with sun control film. In order to see what is inside participants must push the switch to light an internal light. See the student data sheet for student procedure.

SOUTHEAST REGIONAL ENVIRONMENTAL EDUCATION BOARD AND QUARRY HILL NATURE CENTER

SOLID WASTE LEARNING STATIONS
Student Data Sheet

Name: _____

ACTIVITY 1 - MOUNTAINS OF WASTE

Total amount of solid waste produced per person per year _____lbs.

Plastics _____ Metals _____ Paper _____

Glass _____ Rubber _____ Wood _____

Food _____ Yard _____ Misc. _____

ACTIVITY 2 - SEPARATION AND SALVAGE

Not available at this time

ACTIVITY 3 - NATURE'S RECYCLING

Material	years to rot	Material	years to rot
A. Glass	_____	E. Corn cob	_____
B. Wood	_____	F. Plastic	_____
C. Paper	_____	G. Food	_____
C. Tin	_____	H. Aluminum	_____

ACTIVITY 4 - OUR TIRED ENVIRONMENT

How many tires are there in Table A? _____

Using the multiplication factor of 10,000,000, determine the total number of tires which will be thrown away each year _____.

Read the following story and fill in the blanks: Mr. Driver travels 10,000 miles per year for 4 years. How many tires does he use and throw away if he buys bias ply tires that last 20,000 miles? Count the tires in Table B for the correct answer _____tires.

Mr. Driver decides instead to buy radial tires that last 40,000 miles. How many of these more durable tires does he use and throw away? Count the tires in Table C for the correct answer _____tires.

If Mr. Driver decides to retread his old tires, how many of each type of tire will he have to throw away? Count the tires in Table B for the correct number of retreaded bias ply tires _____. Count the tires in Table E for the correct number of retreaded radial tires _____.

ACTIVITY 5 - DO WE NEED TO RECYCLE?

Metal	year gone	Metal	year gone
Aluminum	_____	Copper	_____
Nickel	_____	Iron ore	_____
Chromium	_____	Tin	_____
Silver	_____	Lead	_____

ACTIVITY 6 - THE THROW-AWAY MENTALITY

FOLLOW THE BLACK ARROWS

MANUFACTURER	Mining of tin	_____
	Metal processing	_____
	Transportation	_____
	Paper label	_____
	Transportation	_____
	Sub-total	_____
PROCESSOR	Storage	_____
	Canning	_____
	Storage on shelf	_____
	Food distribution	_____
	Sub-total	_____
CONSUMER USE	Transportation	_____
	Electrical can opener	_____
	Sub-total	_____
DISPOSAL	Litter clean up	_____
	Landfill	_____
	Sub-total	_____
	TOTAL	_____

FOLLOW THE RED ARROW

REPROCESSING (RECYCLING) _____

If a can were reprocessed (recycled) which 3 black arrow steps would be unnecessary?

_____, _____, and _____.

What is the total energy used by those 3 steps? _____.

What is the energy cost for reprocessing (recycling)? _____.

How much energy will be saved by reprocessing (recycling)? Subtract the two numbers above _____.

ACTIVITY 7 - WHAT IS NEEDED?

If a baby's disposable diaper were changed 6 times per day, how many diapers would a baby use by the time he/she were toilet-trained at 18 months.

30 days x 18 = _____days, 6 diapers @ day x _____days = _____ number of diapers.

If a man used 6 15-blade refills for his reusable razor, and each one costs him $3.00, what would his shaving cost him in a year? $ _____. If he used 91 throw-away razors at 25¢@, what would his shaving cost him in a year? $ _____. How much money would he save by shaving with a reusable razor? $ _____.

The material which comes with a fast foods hamburger, (wrapper or styrafoam package, paper sack, catsup, container, napkin) weighs about 60 grams or 2 oz.

One fast foods chain advertises 18 billion hamburgers sold. Calculate the amount of solid waste from this effort. _____grams. _____oz.

ACTIVITY 8 - MAN'S PACKAGING

Weight of packaging for 18 oz. of cereal in single packs _____g.

Weight of packaging for 18 oz. of cereal in variety packs _____g.

ACTIVITY 9 - COMPOSTING

	TEMPERATURE
Jar A	_____
Jar B	_____
Jar C	_____

ACTIVITY 10 - NATURE's PACKAGING

What do you get when you buy an orange? _____, _____,

_____, _____, _____, _____,

_____, _____,

What do you need when you buy an orange? _____.

ACTIVITY 11 - DISPOSAL METHODS

Match the letter on the display with the disposal method illustrated.

Fuel Source _____

Fertilizer (composting) _____

Recycling _____

Land fill _____

REGIONAL ENVIRONMENTAL EDUCATION COUNCIL

Teacher Data Sheet

SOLID WASTE SEMINAR

ACTIVITY 1 - MOUNTAINS OF WASTE

The numbers which should be recorded on the student answer sheet are as follows:

Total amount of solid waste produced per person per year is 1400 lbs.

Plastics	51.8 lbs.	Metals	130.2 lbs.	Paper	459.2 lbs.
Glass	138.6 "	Rubber	26.6 "	Wood	50.4 "
Food	232.4 "	Yard	259.0 "	Misc.	51.8 "

Miscellaneous wastes include things like construction wastes. Although this does not seem like such a huge amount; students should be encouraged to figure amounts for their family, for the town or city in which they live and perhaps even for the entire state. (*State population: 3,804,971 - 1970 Census*)

Even though the purpose of this activity is to demonstrate the volume of solid waste, it should also initiate discussion on how to reduce this "mountain." The techniques of source reduction and recycling are important here.

ACTIVITY 2 - SEPARATE & SALVAGE

The property of solid waste demonstrated in this display is that it can be separated by magnetism. This display shows only a simple form of separation and is intended to illustrate that (1) wastes can be separated and (2) many forms of solid waste are worth being recycled. Other methods of separation involve the different densities of materials floated in water or forced air. In many cases "front-end separation" is practiced which involves the households separating glass, plastic, metals, paper and food wastes which are picked up separately by the haulers.

ACTIVITY 3 - NATURE'S RECYCLING

Students will have a difficult time coming up with reasonable answers because it is beyond their experience. The following chart, however, will be of help in your discussion.

Material	Time Needed for Complete Decomposition
Iron	About 100 years
Plastic	About 350 years
Paper	From 3 months to several years
Wood	From 6 months to several years
Bread (food)	From 3 to 6 months
Aluminum	About 500 years
Glass	Millions to billions of years
Plant material	From 1 month to several years

Questions posed to students might be as follows: Which material decomposes the fastest? - the slowest? What do you notice about the decomposition rate of the organic (wood, food, plants & paper) materials compared with the inorganic (glass, plastic, iron, aluminum) materials?

The key question at this point is to have students come up with a reason for recycling rather than disposal.

The decomposition rates that have been listed are very approximate. Decomposition depends not only on what material is buried, but also on the soil type, climate type, and amount of moisture in the soil, as well as other factors.

Glass does not really decompose but rather becomes ground into finer and finer particles that become a part of the soil. Some glass has been found from the beginning of civilization. Glass rock (obsidian) may be as old as the earth itself.

Aluminum and iron (along with many other metals) decompose into their respective oxides. Notice the difference in time for that reaction to occur.

Organic materials (wood, paper, food, etc.) decompose the most rapidly because they generally can be attacked by bacteria, moisture, and nitrogen that they contain within themselves.

Plastics are another matter. The figure given on the worksheet (350 years) is a very rough average of the many decomposition rates that the varying types of plastic maintain. These rates range from a few weeks to close to infinity.

Perhaps the most important thing to be learned from this display is that our civilization's legacy is rapidly becoming more and more saturated with "trash." Once a person realizes that most of the material he "tosses out" lays in the ground long after he has died, he may think more seriously about recycling those same materials.

ACTIVITY 4 - OUR "TIRED" ENVIRONMENT

The student data sheet should have the following answers:

Table A contains 17 tires which represents the 170,000,000 tires discarded each year. Table B has 8 tires which represents the tires discarded by a driver who drives 10,000 miles per year for 4 years on regular (non-radial) 20,000-mile tires.

Table C has 4 tires which represents the tires discarded by a driver under the same conditions above but uses radial tires guaranteed for 40,000 miles. Table D has 4 tires which represent the tires discarded by the driver in Table B above who decides to recycle (recap) his tires one time.

Table E has 0 tires and represents the tires discarded by the driver with radial tires who decides to recap his tires.

Don't buy "cheap new tires. Without telling the students this directly, it is hoped they will reach this conclusion.

Tire cracass disposal is a major problem for the tire industry, as well as the environment. Costs for disposing of old tire carcasses vary; but in one region of the U.S. it approaches 25¢/tire. This cost forces the industry to look for ways to reuse tires rather than just dumping, burying or burning them. Besides, buried unshredded tires just work their way back to the surface, and open burning or dumping is against most pollution ordinances. Some of the new ways the industry has found to reuse old tires are:

1. Combustion to produce energy in the presence of pollution controls.

2. Reclamation of resources making up the tire. Research shows that 11 million tires yield: 14 million gallons of oil, 10 million pounds of steel and 63 million pounds of carbon black. Recovery costs are prohibitive at the present but a pilot plant in Colorado is trying to bring these costs down.

3. Construction of artificial reefs. In the Puget Sound, many such reefs exist and are providng excellent habitat for invertebrates and fish. Environmentally, there appears to be no adverse effects.

4. Floating breakwaters.

5. Highway crash barriers.

6. Artificial turf.

7. Ground cover to prevent soil erosion.

These uses are limited and cannot come close to utilizing the entire bulk of tires being discarded. So, for the present, the consumer determines how many tires are disposed of each year by the type of tire he purchases.

Retreading or recapping tires is not new. The mining industry has been doing this for years and has saved literally millions of dollars. However, many people still don't have confidence in retreaded tires. The crux of the matter is that the process is a good one and the quality of the retread is dependent upon the quality of workmanship, and the condition of the tire carcass which is to be recapped.

Radial tires do cost more initially; however, they last much longer than regular tires and their carcasses will yield a much higher quality retread than a regular carcass will. In the end, studies have shown that recycling radial tires is the cheapest way to purchase tires. Granted, the savings in money will be small, but the savings in energy and environmental damage will be significant.

ACTIVITY 5 - DO WE NEED TO RECYCLE?

This map shows some of the sources of supply of various minerals and the year that their supply is expected to be gone. These figures are as follows:

Chromium	2100	Tin	2020
Iron	2100	Copper	2015
Nickel	2060	Lead	2010
Aluminum	2040	Silver	1995

It is important for students to reduce this information to number of years left of the material. It will mean more if they can understand that there are 35 years supply of a mineral left rather than the supply will be gone in the year 2012. It would also be effective to have students determine their age when a mineral is gone.

The data given here represents estimates based on present known reserves and present rates of consumption. If consumption increases the mineral will be gone sooner; but, if new reserves are found, it should last longer.

The point of the activity is to demonstrate the finite supplies of several important metals. Recycling of these metals would definitely prolong the depletion. Non-renewable resources should be discussed and the fact that once they are gone, there are no more.

ACTIVITY 6 - THE THROW-AWAY MENTALITY

The energy cost shown in the display is as follows:

Manufacture	Mining of tin	300
	Metal processing	200
	Transportation	20
	Paper label	2
	Transportation	2
Processor	Storage	5
	Canning	75
	Storage on shelf	5
	Food distribution	20
Consumer use	Transportation	3
	Electric can opener	1
Disposal	Litter clean up	10
	Landfill	20
	TOTAL	663
Reprocessing (recycling)		100

It is easy to see that if the can were reprocessed or recycled mining of tin, litter clean up and landfill would be unnecessary steps. These three steps cost 330 units of energy. The energy expended for recycling is 100 units. The savings of energy reprocessing will be 230 units.

The units of energy described in this Activity 6 are British Thermal Units or BTU's.

You may notice that the energy cost of consumer preparation of the soup has not been included in this display. The object of the activity, however, deals with the can and not its contents. If the soup can is not recycled, not only does it represent a waste of energy, but also requires landfill space and use of more metal to make a new one. Each of these produces air pollution and may produce water pollution as well as using up a non-renewable resource.

ACTIVITY 7 - WHAT IS NEEDED?

This activity demonstrates the material which is supplied to customers when they purchase photo supplies or fast foods. (End panels) The center panel illustrates a number of items sold as disposable, i.e., they are intended to be used one time or several times and then added to our mountain of solid waste.

The student data sheet should have the following answers:

1. Disposable diapers - 6 diapers per day - toilet trained at 18 months.

   30 x 18 = 540 days 6 diapers x 540 da. = 3,340 diapers

   For additional impact - If it takes one tree to produce 100 disposable diapers, how many trees are needed to toilet train one child?

2. Disposable razors - the cost of 6-15 blade refills for a reusable razor at $3.00 ea. would be $18.00. The cost for 91 throw-away razors at 25¢ = $22.75. The savings in cash for using a permanent razor would be $4.75

   For added impact - Determine the solid waste produced by the reusable razor (each blade = 10 grams) and the disposable razor (each razor = 100 grams). (The weights here are approximate.)

The whole point of this center panel on disposables is that it is often more economical to reuse than it is to buy throw-aways. It is certainly more economical from the natural resource standpoint.

The left-hand panel illustrates the deluge of material coming from photo shops which is not essential to the product which is being purchased. There is no reference to this on the student data sheet.

The right-hand panel asks an impossible question: *If the solid waste from a hamburger weighs 60 grams or about 2 oz., how much solid waste has been produced by the production of 18 billion hamburgers?* The answers are 108 million kilograms, 36 billion ounces or 2 billion 250 million lbs.

These are difficult problems for students to handle at best, but it points up the difficult problem of source reduction. How can we

get businesses to reduce the amount of paper and plastic which they use? Is it all really necessary? What are the problems connected with its disposal? How much of it can be recycled? Interesting questions for discussion.

Activity 8 - Human Packaging

This activity points out the poor conservation and increased solid waste disposal problem in cereal packaging. The student data sheet should have the following answers:

> Weight of packaging for 510 grams (18 oz.) of cereal in a single pack is 98 grams or 3.3 oz.
> Weight of packaging for 510 g or 18 oz. of cereal in variety packs is 205 g or 7.5 oz.

It is important to note here that it takes 2 variety packs to equal the same amount of cereal in the single pack. The cost for the cereal in the variety pack is 1½ times the cost for the single pack. So once again the undesirable packaging method costs the consumer more money to buy and it is more difficult to dispose of.

Activity 9 - Composting

This activity shows the difference between organic and inorganic decomposition. The temperatures in each jar will vary but Jar B should always be warmer than A or C. Jar A contains metal; Jar B contains food wastes and paper; Jar C contains glass.

The temperature increase in Jar B is an indication of bacterial decomposition which is breaking down the solid wastes into compost. This is much more easily disposed of than the original forms of the waste.

It is important to note that only the organic materials can be composted. The metal, glass, plastic, etc., will not be broken down by bacterial action.

Activity 10 - Nature's Packaging

This activity asks the question: *What do you get when you buy an orange?* The student data sheet should include:

orange	cash register slip
fiber tray	trading stamps
plastic covering	game card
grocery sack	game rules

The second question asks: *What do you need when you buy an orange?* The answer is <u>nothing</u>.

The idea of nature's packaging for fruits and vegetables may not be apparent to those who buy all their food in man-made packages. The orange peel is really all that is necessary. It can be washed

easily, is easily removed, smells good and can be disposed of easily because of its organic origin. This is not always true with man-made packaging.

ACTIVITY 11 - DISPOSAL METHODS

Student data sheet should have the following answers:

Fuel source	B
Fertilizer (composting)	A
Recycling	C
Landfill	D

This activity is designed to call attention to some methods of disposal of solid waste. It is common practice to recycle animal wastes to the fields as a fertilizer. Are there other forms of waste which could be recycled this way? How about the dry sludge from sewage disposal plants. Have your students find out about the fertilizer Milorganite.

About 33% of solid waste is paper and newsprint. It can be valuable as a source of fuel or can be recycled to make more paper. It can also be used as an insulation. The EPA figures show that 16.5% of paper waste is being recycled. A much smaller amount is being used as a fuel source yet in a study done in Rochester, MN, 15% of the energy needed to run a new power plant could come from combustible solid waste like paper. It is an energy resource which needs our attention and investigation.

Recycling is the most common method of conserving natural resources and reducing the energy budget for production. Yet of 9.3% of domestic solid waste is metal but only 1.6% of that is recycled. Most of this is aluminum, steel and copper. Should we be recycling other metals? How about plastics, tires, glass, etc.?

The landfill is the accepted method of disposal of solid waste. It is at best a costly and inefficient method. Ground water pollution, air pollution, sight pollution are all common with landfills. Sites for landfills are increasingly difficult to find and our increasing generation of solid waste is filling available sites rapidly.

The obvious solutions are to reduce the generation of solid waste (source reduction) and recycling all that is recyclable.

REGIONAL ENVIRONMENTAL EDUCATION COUNCIL

SOLID WASTE SEMINAR

HOW'S YOUR SOLID WASTE IQ? NAME: _____

Read the following statements and decide whether you think each is *true* or *false*. Circle the T for statements you think are *true* and the F for statements you think are *false*. When the paper has been corrected, check your Solid Waste IQ below.

18-20 High - You have a good knowledge of solid waste processes and problems.

15-17 Fair - You have a fair knowledge of solid waste processes and problems.

0-15 Low - You need to gather more information to improve your understanding of the problems of solid waste.

T F 1. Minerals will decompose in a landfill faster than plant remains like grass clippings and corn cobs.

T F 2. Landfills (dumps) could become the mines of the future.

T F 3. Radial tires last longer than non-radial tires.

T F 4. Non-radial tires are easier to dispose of than radials.

T F 5. There are some useful materials in an old tire such as oil and steel.

T F 6. Each person produces about 1,400 pounds of solid waste each year.

T F 7. Paper is the solid waste category which is the greatest amount by weight.

T F 8. Disposable items like razors and paint brushes are always cheaper to buy.

T F 9. More natural resources are consumed to produce disposable diapers than producing reusable diapers.

T F 10. When organic materials decompose by bacterial action, the temperature of those materials rises.

T F 11. Nature's packaging of fruits like oranges, bananas, and apples is not sufficient to protect the fruit and requires additional packaging by man.

T F 12. Reducing the amount of solid waste produced is one good way to help solve the problem of solid waste disposal.

HOW'S YOUR SOLID WASTE IQ?

T F 13. None of the metals we now use in industry will be gone in your life time.

T F 14. Recycling of metals can help conserve the reserves of metals in short supply.

T F 15. In the production and use of a tin can, the greatest energy use comes in the mining and metal processing.

T F 16. The amount of energy saved by recycling a tin can is not important enough to make it practical.

T F 17. Solid waste disposal is really a big environmental problem.

T F 18. Landfills may cause water, soil and air pollution.

T F 19. One of the ways to separate iron and steel from other waste materials is to float it in water.

T F 20. All of the paper and printed material which comes with pictures from the photo shop is necessary to protect the pictures.

QUIZ ANSWERS

1. F	10. T
2. T	11. F
3. T	12. T
4. T	13. F
5. T	14. T
6. T	15. T
7. T	16. F
8. F	17. T
9. T	18. T
	19. F

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